The President read a paper on the luminous phenomena produced by the discharge of Ruhmkorff's induction apparatus in vacuo.

"Although this beautiful experiment has been carefully examined by several distinguished philosophers, whose results may be found in De Moncel's pamphlet, I hope I may be excused for calling attention to it; as in repeating it I have observed some facts which seem to require further elucidation, and which I wish to point out as deserving of notice to those who possess more perfect apparatus than I command.

"The Ruhmkorff which I use is of the smaller size, containing about 6700 feet of fine wire, and excited by one or two Grove's cells; its compensator is of thin sheet gutta percha, each of whose coated surfaces is 8 square feet; and the terminals of the secondary helix are occasionally connected with a Leyden jar of 1·25 feet internal coating. The air-pump is a make-shift, altered from one of the commonest kind; but on a principle which, with good workmanship, would act well.

"1. When the discharge takes place in the vacuum formed by exhausting common air from the receiver, or (as Grove calls it) the air vacuum, the appearances are well known. As I observed them, if the terminals are platinum points, 4 inches apart, and the gauge $0^{i}{\cdot}10$, a star is formed at the positive one, pink, tinged with orange. From this darts a rich stream of violet light, crossed with dark bands, which are most distinct at its lower extremity; it seems to revolve on its axis, and is enveloped in an elliptic mass of faint yellowish light. It terminates at $0^{i}{\cdot}7$ from the negative point, and about $0^{i}{\cdot}5$ is completely dark; the negative terminal is wrapt in a coat of bright blue light, through which, by an optical delusion, the platinum *seems* red hot: round this is a dark space, then a yellowish envelope, and round this a purple haze. The appearances are nearly the same when the terminals are brass balls; with the addition that the negative ball is covered with green flames, owing to the combustion of the brass. Each of these consists of a speck of

white light surrounded by a green atmosphere. When the negative ball is removed, and a disc of varnished card, 2 inches diameter, screwed in its place, with the point projecting in its centre; a sheet of light spreads over the disc, doubling round it and enwrapping the stem. It is remarkable that whatever forms the dark bands, is effective here, covering the disk with bright rings, which, when the eye is in its plane, look like a succession of waves. In all these cases the stream, as was shown by Eisenlohr, is rich in those rays which produce Stokes's fluorescence; drawings or writings made on paper with acid solution of sulphate of quinine, which are invisible in common light, gleam out intensely white on a purple ground; and ornaments of Uran glass look strangely bright. Even the glass of the receiver becomes luminous under their influence. Sometimes, however, this does not occur, and the light of the stream is livid; in this case it will be found that oil from the collar of leather has been decomposed by the discharge. Of these phenomena the most notable are the rotation of the light, the dark bands, the discontinuity of the light near the negative terminal, its separate luminous envelopes, the anomaly of combustion taking place there rather than at the positive terminal, and the extraordinary quantity of fluorescent rays. These last might be supposed essentially inherent in the electric light; but it will be seen that they are due to the special character of the medium.

"2. Introducing into the receiver a morsel of blotting paper moistened with distilled water, the gauge could not be got below 0·4. The column of light was much narrower and brownish red; there were no bands which I could see, and scarcely a trace of fluorescence. The powerful effect of watery vapour in thus modifying the appearance of the discharge indicated the necessity of completely drying any gases experimented on, which was in all other cases but one effected by enclosing in the receiver a vessel exposing 8 square inches of sulphuric acid, and letting it absorb for twenty-four hours.

"In vapour of turpentine the stream was narrow and dull fluorescence very faint. At each of the pointed terminals was an intense green star, even when they were platinum and from the negative one red hot globules were projected, too obscure to be melted platinum, and therefore probably carbon from decomposition.

"In vapour of alcohol, gauge = $0^{i}\cdot7$, the stream, which (as in the other vapours) was much contracted, was blue, with a tinge of green. The terminals (balls in this instance) were covered with green sparks, which on the positive one at least do not depend on combustion of the brass. Here also was little fluorescence, and as there is no note of dark bands, I suppose they were not conspicuous.

"As air was present in these vapours, it may be concluded that the fluorescence actually observed is due to it, and not to the vapours.

"3. The receiver was filled with coal gas from a burner. The sulphuric acid probably absorbed some hydrocarbon from it as it became brown. It was exhausted to $0^{i}\cdot08$. The light was livid white, giving the idea of an excess of the more refrangible rays, though the prism showed much red. There was not more fluorescence than could be explained by the common air with which commercial coal gas is often adulterated. It, however, exhibited the true nature of the dark bands; they are intervals between the luminous menisci of which the entire column of light is made up, the centre of whose curvatures is the bright point on the positive terminal from which the discharge breaks out. This structure is far more beautifully exhibited in—

"4. Hydrogen. It was obtained from Liege zinc and diluted sulphuric acid, and passed through solution of potassa. The terminals were, in the first case, the point with its card disk already described, and an inch ball. When the gauge was $1^{i}\cdot15$ (the Ruhmkorff being excited by three Groves), the discharge passed as a crimson spark $3^{i}\cdot5$ long and $\frac{1}{16}$ thick.

Round it was a faint envelope, in which were close dark bands, not traced in the spark itself. With gauge $0^{i}{\cdot}85$, they extended over all, about 50 to the inch, black and sharply defined. With $0^{i}{\cdot}07$ the appearance was superb, something like the sketch.

"There are about 25 of the menisci whose concentricity with the luminous point on the ball I verified by comparing them with circles drawn on paper, and placed behind the receiver; the lowest I estimated at $1^{i}{\cdot}25$ broad. Below the dark space the light doubled over the disc, but without rings, and then clothed the stem with its purple envelopes. There was no fluorescence, at least not enough to make the quinine drawings visible. This was repeated with ball terminals, exhausting the receiver four times successively, as often filling it with hydrogen, and leaving it as many days in contact with the sulphuric acid. The interval of the balls was three inches,

and one Grove was used. The discharge did not pass till the gauge was 0·70. The light was pale, greenish blue; the envelopes of the negative ball not blue, but reddish, yet no trace of fluorescence. The fine dark bands were seen as before, and were visible when the contact was broken by hand, so as to give a single flash, which seems to show they do not depend on the succession of discharges. At 0^{i}·10 the bands were curved and broad, and the stream trumpet-shaped; the negative ball had its three envelopes, and round them a wide, faint, blue haze. At 0^{i}·05, the lowest which the pump could then give, the light was faint and wide, but still blue; and each of the menisci, which are now fully developed, was, with its interval, about 0^{i}·25 across. This vacuum conducted so well, that, though the negative ball was connected with the pump plate by copper 0^{i}·2 by 0^{i}·15 section, a sheet of light passed round the sulphuric acid holder, and covered the plate with green sparks.

"The total absence of fluorescence here is very striking, and I rather hastily concluded, that this property depends on the presence of free oxygen in the vacuum.

"5. Oxygen, procured from chlorate of potassa and peroxide of manganese, and passed through solution of potassa, was next tried; gauge at 0^{i}·08. The appearance differed little from common air; the light was equally fluorescent, and the only difference noticed was, that the green sparks at the negative ball were more numerous and intense. After a while the light became greenish and the fluorescence less, then it got a peculiar copper colour, which soon passed off, and it became as at first, except that the dark bands became much more distinct. Was this owing to the formation of ozone? On increasing the distance from 3^{i} to 4^{i}·75, the bands were scarcely visible in the middle, but reappeared towards the negative ball.

"6. I tried nitrogen prepared by leaving for four days in a confined portion of air a paste of equal parts of sulphur and

iron filings moistened with water. On this occasion chloride of calcium was used to dry the vacuum, but did not act as well as the sulphuric acid, for the gauge could not be got below $0^{i}{\cdot}25$. The light was faint till the Leyden jar was connected, when it appeared as a violet spark, surrounded by a yellow atmosphere. The envelope of the negative ball was yellowish, not blue, and no bands were noticed; but the fluorescence was strong. As both watery vapour and hydrogen were probably present, I repeated this experiment, obtaining the gas by a process for which I am indebted to Dr. Lyon Playfair, decomposing water of ammonia by bleaching powder. The ammonia must be diluted, the Wolfe's bottle in which the decomposition takes place kept cool, and the gas well washed. The extrication of it, though very rapid, is manageable, and it seems to be quite pure. From the nature of the manipulation in filling the receiver, I am sure that it could not have contained more than $\frac{1}{300}$ of common air. The discharge began to pass at $0^{i}{\cdot}30$, a brilliant reddish violet; the light on the positive ball more pink than in air; that on the negative one, indigo; the bands obscure, but the fluorescence intense. On continuing the exhaustion to $0^{i}{\cdot}04$, the colour of the stream became a tawny brown, and much fainter, the menisci became distinct, and the fluorescence continued strong.

"7. Carbonic oxide was procured by heating crystals of oxalic acid with eight times their weight of sulphuric acid. As some of the carbonic acid might pass the potassa solution from the rapid way in which the extrication takes place, a vessel containing that solution was placed in the sulphuric acid vessel to complete the absorption. At $0^{i}{\cdot}15$ the stream is beautiful; bright green, yellowish at the positive end, bluish at the other. The latter has still the two envelopes separated by a dark interval, and green combustion sparks on it. The stream is not broad, but shows the menisci in all its length very plainly. At $0^{i}{\cdot}12$ the negative envelopes became blue

and red, the light much broader and fainter; the menisci were seen only in its central part, and disappeared for $1^{i}{\cdot}5$ of its middle; the fluorescence scarcely sensible.

"8. With carbonic acid, gauge $0^{i}{\cdot}07$; the positive ball was covered with orange-yellow light; from this sprung a faint lilac mass of light for 2^{i}, in which bright menisci show occasionally. Below is 1^{i} dark; and below this, bluish haze in which is the negative ball with its red, dark, and blue envelopes. Fluorescence extremely feeble.

"Another experiment was made, intending to obtain a perfect vacuum on Dr. Andrews' plan, by absorbing the carbonic acid. The potassa solution, however, became solid when the gauge was $0^{i}{\cdot}04$. The positive ball was covered with the same yellow shade, from which issued a pear-shaped mass of livid lilac, with a brighter axis, the whole full of the menisci, but faint; it was in rapid rotation, and its point rose and fell, sometimes crossing the dark space between it and the steady spherical light surrounding the negative one. In this case also the fluorescence was scarcely sensible.

"From these facts it appears that nitrogen has, as well as oxygen, the power of producing the invisible rays which cause fluorescence. Hydrogen, and compounds of it with oxygen and carbon, seem totally to want it; carbon is probably in the same predicament, and it becomes an interesting question whether other highly electro-positive bodies resemble them. On the other hand, how will chlorine and its congeners comport themselves? I could not try other gases for fear of destroying my air-pump, but an apparatus contrived by Mr. Bergin will, I hope, enable me to extend my experiments. It is like a mercurial gasometer, in which the bell-glass has a small opening at its top; the circumference of the aperture is ground flat, so that it can be covered by a flat disc of glass, slightly greased. Through the centre of this disc passes a platinum wire. When the bell is pressed under the mercury, all air escapes, especially if it be exposed for a

while in vacuo. Then applying (still under the mercury) the disc, the bell rises by its flotation, till this is balanced by the weight of mercury which is raised in it. If, however, it be placed under a receiver, on exhaustion the bell rises about four inches, leaving a Torricellian vacuum within, through which, by bringing the sliding rod of the receiver in contact with the platinum wire, discharges can be made. A hole $0^{i}{\cdot}2$ diameter, and $1^{i}{\cdot}0$ long, is drilled in the apex of the cast-iron core, by inserting in which a miniature jar of quill-tube, filled with a known bulk of any gas, before applying the covering disc, this will escape when the bell-glass rises, and thus enable one to experiment in a vacuum of that gas at any required attenuation.

"With respect to the next in interest of these facts, the existence of the luminous menisci, I am unable to form an opinion as to whether the differences which I have mentioned arise from specific qualities of the gases, or merely from the degree of density. The decided manifestation of them in hydrogen would seem to imply the latter. If so, air at 0.06 should show the same as I have described for hydrogen at 0·85 and at 0·005, as the other at 0·07. The latter exhaustion will require a better pump than mine to try it: but in the first the hydrogen shows the phenomena far more distinct than the air, and the same thing is true of carbonic acid, notwithstanding its high specific gravity.

"My present notion of these menisci and their divisions is, that they are surfaces of interference. The fact of their being produced by a single discharge shows that they do not depend on the discontinuity of the current (unless, indeed, that single discharges may be a succession of waves); and the absence of the negative blue light seems equally to show that they do not result from zones of alternating electric condition in the medium.

"The colour is related to the nature of the medium; but the rotation of the positive portion of the light, the quiescence of the negative, and its invariable division into two

envelopes, separated by a dark interval, seem to belong to the very essence of the discharge itself."

The Rev. J. H. Todd, D.D., Secretary of the Academy, read the following letter from Dr. Jacob Grimm, H.M.R.I.A., on certain formulæ or charms supposed to be in an ancient Celtic dialect, which occur in the works of Marcellus, a physician of the age of Theodosius the Great.

"*Berlin*, 20 *juin*, 1855.

"MESSIEURS ET HONORÉS CONFRÈRES—Je pris, il y a quelques ans, la liberté d'attirer votre attention sur une mince découverte, que je venais de faire. Il s'agissait de prouver, qu'un médecin du temps de Théodose le grand, natif d'Aquitaine, avait inséré dans son ouvrage de médecine quelques formules jusqu'ici inexpliquées ou plutôt négligées, mais conçues dans un dialecte gaulois, qui parait avoir été très-voisin de l'idiome irlandais. Ces formules constitueraient donc le monument le plus ancien de votre langue et sembleraient dignes d'une étude particulière.

"Messieurs, vous êtes les juges naturels de cette question, mais vous n'avez pas cru à propos d'énoncer votre opinion sur elle, ni même de faire la moindre mention de ma conjecture dans vos proceedings. Cela m'a, je l'avoue, découragé au point de laisser tomber toute cette recherche.

"Dernièrement elle a été suscitée de nouveau. Monsieur Pictet de Genève m'ayant transmis son heureuse explication de plusieurs formules de Marcellus je me suis, de mon côté, livré à une étude réitérée de cet intéressant document de l'antiquité, et j'ai pû ajouter encore quelques éclaircissements à ceux de Pictet.

"Il est de mon devoir de vous adresser un exemplaire de cette dissertation. Je serais curieux d'apprendre, si vos anciens manuscrits offrent peut être de semblables formules (des spells, en Anglais), rédigées soit en Irlandais ou en Latin, et propres à jeter du jour sur celles de Marcellus.